The Ins and Outs of Scaling Up AI: Dr. Donald Wunsch

https://mindmatters.ai/podcast/ep376

Announcer:

Greetings and welcome to Mind Matters News. This week, we're continuing our conversation with Dr. Donald Wunsch on his experiences with AI and his recent article in the IEEE Computational Intelligence Magazine about artificial general intelligence. This is the second part of our conversation with Dr. Wunsch, so if you've not listened to the first part, I'd encourage you to do so. Now here's your host, Robert J. Marks.

Robert J. Marks:

It seems to me that the center that you are overseeing is doing, from what I see on your webpage, doing fascinating things. I think most of the heavy lifting in AI is being done by industry now, OpenAI and Grok and Perplexity and Amazon and all of these others. And at universities, we're primarily interested in incorporating artificial intelligence into everyday tasks. So that's kind of what we're doing here at Baylor University.

There's an old saying that in order to have a poet laureate, you have to be a rich country, and I think the same thing is with industry. In order to have a good research basis in industry, you have to be very rich. When I was a boy, it was Bell Labs. Bell Labs had all of these great scientists, Claude Shannon and Richard Hamming, and they did just incredible work. And now we have these rich people like Amazon and OpenAI that are doing the same sort of research.

So it's going to be interesting to see what happens to these tools as they get more sophisticated. So let's talk about your paper, artificial...

Donald Wunsch:

Actually, I want to run on that riff for a moment, because it embraces something that's very fundamental to human intelligence, and is more difficult for artificial intelligence, and that is the concept of paradox.

So paradox is something that is really important, and it's a theme in literature, it's a theme in religion, it's a theme in scientific, like Copernican revolution, you could say, built on paradox too. And so, the idea of paradox really is a deep concept that artificial intelligence can talk about it, like an LLM could give you a whole essay about paradox, but to really process paradox, that's something that I think is important, and it relates to the theme that you just wrote. So it is both true and false that you have to be rich to do this.

The true part is that ... So for example, I had a student, he took all my classes and he went to a small company in Alexandria called Heron Systems. And Heron Systems got a contract from DARPA, and they entered the AlphaDogFight competition. And it was a David and Goliath result. They beat Boeing, they beat Lockheed, they beat all these big contractors at this full-blown flight simulator, that was a fight or flight simulator where they would engage in dog fights against the other AI contenders, and then the winner could take on a real human, and they took on the real human and they clobbered them.

Robert J. Marks:

Wow.

Donald Wunsch:

And so, they were taken over by another company called Shield AI, and he's still doing that, and he was a wonderful student. And anyway, this idea, this is the David side of it. But the Goliath side is this. I asked him, "Well, what worked for you?"

And he said, "Well, our first grant had 900K from DARPA. They had phase one, and then they had to go phase two, and then they got to fight against the human pilot. So our phase one, we spent the majority of our money on the hardware. So we bought the GPUs and we ran them all the time, pretty close to 24/7, and that's what worked for us. The algorithms were the things that I learned. It wasn't some algorithmic breakthrough, we were just doing good engineering of good algorithms and then just a lot of fine-tuning of those algorithms."

And so, not changing the algorithms, but you do something and it works or it doesn't work and you make some tweaks and you do it again, and good engineering. And so, that is a microcosm of what's going on now. So that's why you see the companies racing to scale up, because that approach is actually pretty effective. You can do things that you couldn't do before if you throw more compute at it.

Robert J. Marks:

Yes.

Donald Wunsch:

That really has made a big difference, and that is going to continue to be a big theme. So people, if they think, "Well, the data centers, they're chewing up a lot of energy and they're expensive and are maybe not in my backyard and we don't want to do that." Well, that is not going away. There will be more of that in the United States, there will be more of that in China, there will be more of that in many other countries, and they're doing it because it works.

It is not the be all and end all to AI. So what I'd say is there's a paradox, that it pays to be able to invest hundreds of billions in this effort to buy your own nuclear reactors, to buy your own big data centers, and to scale it up to where it uses more than a city's worth of energy. That all works and it's a good path to go on, but there still is a space for people to come up with a better idea and to work in their smaller computer and to do things, and then to show that their idea is worth some more investment, and then to work their way up to be on the bigger computer and to do what they're doing.

So there will be some ideas that come out of left field that nobody's anticipating they're going to change the game, and there also will be continued ability of the big players to raise barriers to entry even higher and try to lock out the competition. And that's part of why I'm saying that regulation needs to be done very carefully, or it can stifle innovation. And so, there's this-

Robert J. Marks:

Oh yes.

Donald Wunsch:

The incumbents can pay for lawyers.

Robert J. Marks:

Yes.

Donald Wunsch:

So you and I can pay for lawyer with small L, but the incumbents can pay for lawyers with big L, where it's a division of their company. And so, the more regulation happens, the more you need lawyer with big L, and that becomes a barrier to entry.

So anyway, but paradox, this all comes back to paradox where we need to be able to embrace paradox, and humans understand that, we accept that. We treat it as even an interesting aspect of art and literature, the idea of paradox. We get a lot out of it. This is something that permeates everything, including AI.

Robert J. Marks:

The idea about lawyers, the big companies many times have staff lawyers. And when I consulted for Microsoft, the first thing I did when I went in was met with lawyers, believe it or not, and they explained me-

Donald Wunsch:

I believe it.

Robert J. Marks:

Yeah, they explained me the rules of the game. And I said this before, so I'll say it again, it's probably dangerous to say, but Microsoft has never done anything innovative. They have either bought it, they have stole it, or they have gone to court to win it, and I don't think you can find an exception. And one of the reasons was because of lawyers.

Bill Gates, you and I are from Seattle, you worked for Boeing before you went to Texas Tech and then to Missouri, and Bill Gates' father was a lawyer, Preston Ellison Gates, I think, in Seattle. And I think that the legal background that they had was more of a secret than anything they did innovative. So that's my two cents on that. I don't know, any thoughts?

Donald Wunsch:

Yeah. Well, lawyers have their place and-

Robert J. Marks:

They do.

Donald Wunsch:

I have some relatives and dear friends who are lawyers. And as you know, I have an MBA, and when I took the business law class, the teacher was wonderful and we had exams and homework and readings and stuff to do. But one thing he said at the first day of class and on the last day of class, he said, "If you ever think that maybe you need a lawyer, you probably already needed a lawyer."

Robert J. Marks:

Yes, that's true.

Donald Wunsch:

He said, "There's only one thing you remember from the class. Remember that." Anyway, I admire their dedication to very careful wordsmithing, to make sure that you say what it is that you want to say, and

that you don't say or imply anything that you don't want to say or imply. So anyway, I admire the profession.

But yeah, I'll also say that when Boeing appointed its first lawyer to CEO instead of engineer, there were-

Robert J. Marks:

Oh, really?

Donald Wunsch:

Yeah. This was when I was at Boeing. The guy's name was Frank Shrontz. And if you look at the financial impact of during his term as CEO, you'd say, "This is all rosy. This is all good. The company did well under his watch." But the engineers were saying, "Oh no, this is the first step in the wrong direction." And so, some of the things that were imbued in the company culture, I won't lay the blame on that individual, he was there when I was there, I didn't see anything wrong with him. But I think that the cultural idea of saying the company should be led by a lawyer instead of by a CEO may have led to some of their subsequent problems.

Robert J. Marks:

Oh yes.

Donald Wunsch:

So I can't point to any individual and blame them, but I think that the culture of the company was different when it was engineers from day one to present, and they no longer can make that claim. I still love flying Boeing aircraft. I'm still very grateful for my time at Boeing, stay in touch with my Boeing buddies, and Boeing was good to me and I tried to be good to Boeing. And so, I'm not complaining at all, I'm just pointing out that there are cultural effects of our decisions and we need to be cognizant of those.

Robert J. Marks:

Yeah. One of the guys that we worked with, if you remember, was Tom Caudell who coined the word virtual reality.

Donald Wunsch:

He didn't coin the term virtual reality, but he did have several terms that he did coin, but he was-

Robert J. Marks:

Well, Don, I read it on the web, so it must be true.

Donald Wunsch:

Yeah, but he certainly made a great impact. I have at least one paper with him on the topic of virtual reality. And also I have a video interview of him, much as I do of you with IEEE Computational Intelligence Society History.

Robert J. Marks:

Okay. We'll put a link to that up also, and you can learn about Tom Caudell. Of course, Tom Caudell was always known for his long beard, and so I have-

Donald Wunsch:

Even longer than yours.

Robert J. Marks:

Even longer than mine. Yeah, it went down to his belly button. He was kind of like, what was ZZ Top or Duck Dynasty sort of guy.

Okay. Well, let's give a little bit of talk, and I'd like to at least get a running start into your paper. And the paper was entitled Artificial General Intelligence is Nowhere Near, Artificial Specific Stupidity is Already Here and Policy Implications. One of the big things that I have seen is the definition of AGI, Artificial General Intelligence, changing. And it seems like everybody that's talking about it is talking about something different. It's kind of like talking to somebody about consciousness and nobody defines consciousness, but we all think we know what it is.

It's the same thing with AGI. And you reference multiple definitions of AGI, including from places like OpenAI and DeepMind. What's the importance of these competing definitions? Why do we have to agree on a definition before we proceed?

Donald Wunsch:

I'll say that I don't really accept the premise of the question. In other words, I don't think it's important at all to have a good definition of AGI, because AGI is nonsense.

Robert J. Marks:

Oh, okay.

Donald Wunsch:

But I will mention some people who I admire who tend to agree with that and people who I admire who tend to disagree with that. So the one I'll mention that tends to agree with that, I attended Yann LeCun's keynote at AAAI. I believe it was the one last year in Vancouver, Canada, and he had some excellent comments about it that wound up influencing the paper. And basically saying the whole idea of general intelligence is nonsense, that doesn't exist.

Intelligence is very specific and we have developed our intelligence, and every species has an intelligence that has been shaped by the needs of that organism. So my first PhD, Donell, was joking with me when he was still my student during his first year with me. He saw some map of the dog's brain as it relates to olfaction. So a dog is an olfactory genius. He coined the term walking nose. And so, the great Walter Freeman, who was the pioneer of neural network models of olfaction, and I interviewed him and...

Robert J. Marks:

Okay, now, olfaction is a big word, define it.

Donald Wunsch:

Olfaction is the process of smelling, so the ability to smell things. So anyway, a dog is an olfactory genius and a dog has more neurons devoted to the analysis of smell than we do. So if we could somehow, like the matrix, import a dog's knowledge, even though our nose does not have as good a hardware as a dog's nose for olfaction, we would still see an amazing upgrade in our ability to process signals of smell. We would be able to detect smell a mile away, or stuff like that, if we had that amount of neurons devoted to olfaction.

And not to mention if we got the sensors that a dog has. So basically intelligence is specific. So Warren Buffett had a great quote about that. He said that, "I'm very rewarded for having an unusual ability to deploy capital. And if you drop me and my secretary in the middle of a jungle, my secretary would do fine and I would be dead in a matter of days, because my skills at deploying capital are not that general use, they're very specific skills."

And so as a species, we have skills that are really optimized for the fact that we're social animals, but they also are optimized for other things that humans need to be good at. But then we further optimize those as individuals, partly by a diversity of what we're born with, the equipment we're born with in between our ears, but then how we develop that as we age. And so, the argument that LeCun made that I thought was wonderful is that general intelligence is actually not so general. And so, in his keynote, he actually used the term nonsense, but he also said, "We're kind of stuck with the term. So many people are using the term that we're stuck with the term."

So that's on the side that tends... I won't pretend to speak for him, but that inspired some of my words criticizing the term AGI. I was already skeptical about it, and he gave me some ammo to put in the paper, and I also cited a Berkeley psychologist in that paper. But on the flip side, there's a wonderful documentary that came out a matter of weeks ago, and there's an older one that came out a number of years ago. The one a number of years ago is called AlphaGo, and it was on Netflix, but now it's freely available on YouTube. And there's a more recent one that came out weeks ago, and I wish I remembered the name of it. Maybe I can get it for you.

But they both have a starring role for the recent Nobel Laureate, Demis Hassabis. I'm mispronouncing it. I think Hassabis, Demis Hassabis, D-E-M-I-S, Hassabis. And I believe that he's the most deserving of the several people who have won Nobels in neural networks. So the first one you might recall, Leon Cooper, he didn't win his Nobel in neural networks, he won it for superconductivity, but he was on the board of the International Neural Network Society and he attended IJCNN '91 that you and I were both deeply involved with in Seattle.

Robert J. Marks:

By the way, IJCNN stands for what?

Donald Wunsch:

The International Joint Conference on Neural Networks.

Robert J. Marks:

Okay.

Donald Wunsch:

And so, anyway, the first one was an ICNN in 1987, and you had a big role in converting that to IJCNN by making a deal with the INNS, the International Neural Network Society. And so, Leon Cooper was on the board of that society, and he was the first neural network guy to also have a Nobel Prize, although it was

not for neural networks. And so, there were a few Nobels given this year. The one that I think is the most well deserved, and they're all brilliant, the people who got these, of course, they got a Nobel Prize, they're brilliant and a lot of brilliant people decided to recognize them. But the one by Demis Hassabis, the reason that I think that is a level above not only the other neural network Nobel Laureates, but most of the Nobel Laureates over time, why this is one of the most valuable Nobel Prizes ever given was because he got it for DeepFold.

Robert J. Marks:

Oh, did he win it in physics or was it biology or what, medicine?

Donald Wunsch:

Chemistry. And together-

Robert J. Marks:

Chemistry.

Donald Wunsch:

And together with the University of Washington professors. So they collaborated on DeepFold, and it's the protein folding problem. But what they did was they worked from their results on the game of Go, where they had AlphaGo was a deep neural network combined with reinforcement learning, plus Monte Carlo tree search, those three ingredients together to conquer the Game of Go. I personally thought it would take a century. I had an NSF grant in this area, but I never dreamed that NSF would spend about half a billion dollars to acquire this London startup company that was doing it, because they were showing promise in the game of Go.

And then they basically gave them a blank check. They gave them all the programmers and compute time that they wanted, and they attacked the game of Go. They brought in Go experts, they had tournaments, they did an enormous amount of compute, and they developed a system that they also screened moves. They had move screener. My student, Mohammed Ranakuzaman has that in his 1997 PhD dissertation. And the first person that I know of, the first people that I know of, that applied reinforcement learning to Go were Terry Sejnowski and his brilliant student, Peter Dayan, and he talks about that in my interview with Sejnowski from last year. That's on the INNS History Committee website, but that was one and done for them.

They did a really nice paper. We saw it, we cited it, and then we ran with that ball for a while. So those techniques that really got traction from them were things that had been around for a while, but they really ran with it. They did things that nobody else dreamed that that kind of resources would be thrown at it. And David Silver was doing that with Richard Sutton, I think that's why Hassabis hired him. Hassabis hired him because he was doing such good work in this area, and then they just were off to the races. And that was a good investment for Google. Right after that victory, their market cap went up by billions of dollars.

That's also was... The second documentary, the more recent one, that was a Sputnik moment for China. That's when China decided, "Hey, we got to get serious about this." That's when they declared their goal to be the world leader in AI by 2030. And I think the US is still not taking that goal as seriously as we should. They have been doing things that are advancing them towards that goal, and the US is not making similar moves on the chess board, or Go board if you say. They're allowing these moves to go uncontested in certain cases.

The Chinese will reap the benefits of their investments, and the US investments are far from absent, we've got big investments, but we're not doing some of the things that they're doing that are wise things to be doing. So there's much that we can learn from what others are doing in the field. And so, that's part of the policy implications, part of the story. So I talk about that a little bit in the paper.

Robert J. Marks:

Well, I tell you what, Don, let's have a follow-up podcast. We really haven't even delved into the paper yet, so let's wrap this one up. We've been talking to Dr. Donald C. Wunsch. He is the Mary K. Finley Missouri Distinguished Professor of Electrical and Computer Engineering, and he's a widely respected voice in artificial intelligence and computational intelligence. He is an endowed professor, as his title reflects, in electrical computer engineering at Missouri University of Science and Technology, and he's the Director of the Kummer Institute for Artificial Intelligence and Autonomous Systems.

We're going to do a follow-up with Don and specifically talk about his paper, which I think contains some valuable insight into where we should go and how we should think about artificial intelligence today. So until next time on Mind Matters News, be of good cheer.

Announcer:

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